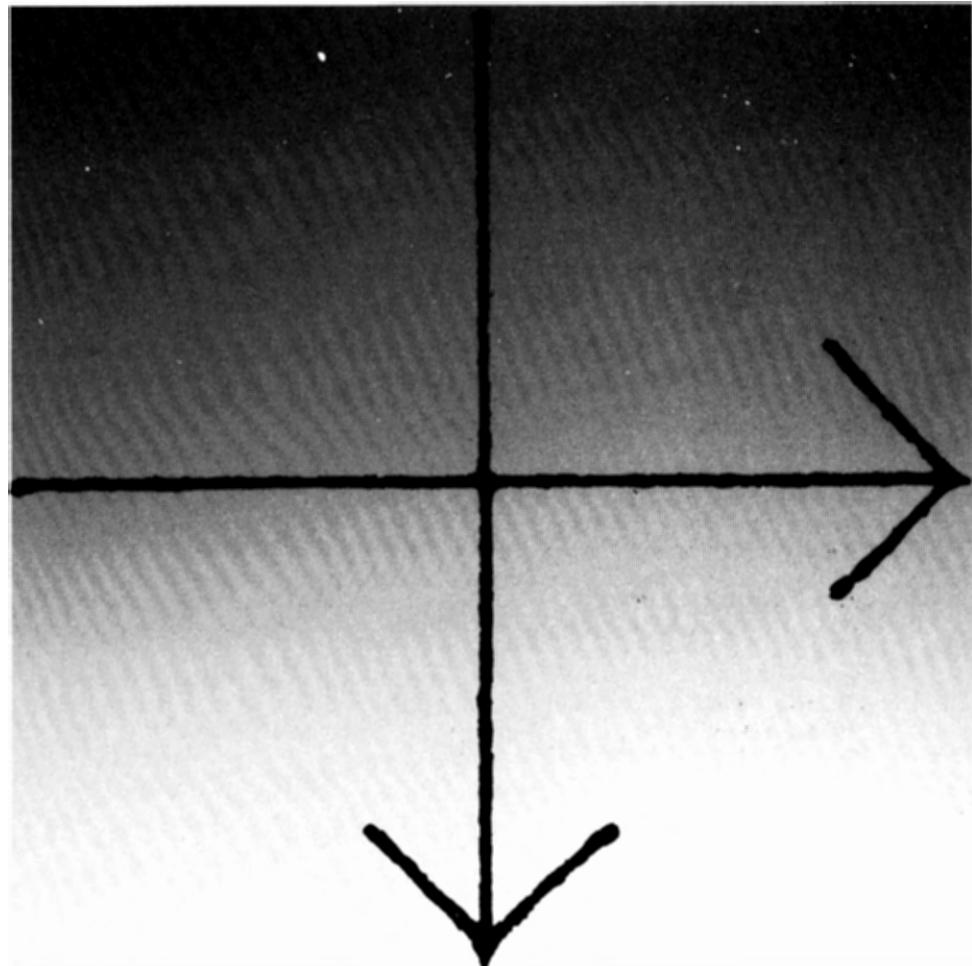


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Diachronica appears twice a year (in Spring and Fall), each issue consisting of between 3-5 articles, a review article, 5-10 reviews, a miscellanea section carrying notes and queries, discussions and reports, and a publications received rubric, which provides capsule information on recent works in the field.

THE ASPIRATED STOPS OF PROTO-INDO-EUROPEAN

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1. INTRODUCTION

According to the Neogrammarian reconstruction of the Proto-Indo-European phonological system, the stop system was characterized by a four-way contrast of (1) plain (that is, unaspirated) voiceless stops, (2) aspirated voiceless stops, (3) plain (that is, unaspirated) voiced stops, and (4) aspirated voiced stops (cf. Brugmann 1904:52), thus:

1	2	3	4	
p	ph	b	bh	(labial)
t	th	d	dh	(dental)
ḁ	ḁh	ǵ	ǵh	(palatal)
q	qh	g	gh	(velar)
q ^h	q ^h h	g ^h	g ^h h	(labiovelar)

In the early 1970's, the Soviet scholars Thomas V. Gamkrelidze and Vjačeslav V. Ivanov together with the British-born American scholar Paul J. Hopper proposed reinterpreting series 3 -- the traditional plain voiced stops -- as glottalized stops (that is, ejectives): *p', *t', *k', *k'w. This theory, which has since gained many adherents, is accepted in full here. Since I have dealt at length with this new theory elsewhere (cf. Bomhard 1979:77-80, 1984:5-10 and 26-31, and forthcoming), there is no need to repeat all of the details here. However, since this theory is intimately connected with the topics under discussion in this paper, a brief summary is in order.

There are several problems with the traditional reconstruction of the Proto-Indo-European stop system that have long defied explanation -- among these problems are: (A) the statistically low frequency of occurrence -- perhaps total absence -- of the voiced labial stop *b, (B) the ex-

clusion of the plain voiced stops from inflectional affixes and pronouns, and (C) the constraint against the cooccurrence of two plain voiced stops in a root. It was in trying to find a solution for these problems that Hopper and Gamkrelidze-Ivanov were led to consider the possibility that the plain voiced stops of traditional grammar may have been glottalics. Basing their arguments on typological considerations, they observed that the patterning of the traditional plain voiced stops exhibited many of the typological peculiarities of glottalics, specifically, (A), in the following frequency hierarchy

/b/ → /p/ → /pʰ/ → /p'/

(the arrows indicate the direction of greater markedness), it is always the labial ejective /p'/ that is the most highly marked, that is, the least common, least frequent, member of the hierarchy, to the extent that it is often missing altogether, (B) glottalics as a class occur only very rarely in inflectional affixes and pronouns, and (C), in languages having ejectives, there is a widespread constraint against the cooccurrence of two ejectives in a root. Thus, the reinterpretation of the traditional plain voiced stops as glottalics provides a natural explanation of the problems mentioned above.

Concurrently with the reinterpretation of the traditional plain voiced stops as glottalics, the traditional aspirated voiced stops -- *bh, *dh, *gh, *gʷh -- have been reinterpreted (A) as murmured stops (Hopper 1973:149-54), (B) as plain voiced stops, which later developed into voiced aspirates in several dialects of "Disintegrating Indo-European" (Bomhard 1984:31-34), and (C) as aspirated voiced stops in which the feature of aspiration is phonemically irrelevant (Gamkrelidze-Ivanov 1973:154-55), that is to say that this series could appear either with or without aspiration depending upon the paradigmatic alternation of root morphemes, while the traditional plain voiceless stops -- *p, *t, *k, *kʷ -- have been reinterpreted (A) as aspirated voiceless stops in which the feature of aspiration is phonemically irrelevant (Gamkrelidze-Ivanov 1973:154; Normier 1977:172; see also Emonds 1972:108-22) and (B) as plain voiceless stops with nonphonemic aspiration (Hopper 1973:152; Bomhard 1984:19-20).

While there is a growing concensus among Indo-Europeanists that the traditional plain voiced stops ought to be reinterpreted as glottalics along the lines proposed by Hopper and Gamkrelidze-Ivanov, there is still no overall agreement on the nature of either the traditional plain voiceless stops or the traditional voiced aspirates.

In this paper, we will first take a look at series 2, the traditional voiceless aspirates, then we will look at series 1, the traditional plain voiceless stops, and, finally, we will look at series 4, the traditional voiced aspirates.

2. THE TRADITIONAL VOICELESS ASPIRATES

The traditional voiceless aspirates were originally posited by the Neogrammarians mainly on the basis of the following correspondences from Indo-Iranian, Armenian, and Greek:

Skt.	Av.	Ir.	Arm.	Gk.
ph	f	f	p'	φ
th	θ	θ	t'	τ
kh	x	x	x	x

In the remaining daughter languages, the traditional voiceless aspirates and plain voiceless stops have the same treatment, except that **kh* → *x* in Slavic. In Armenian, the dental voiceless aspirate and plain voiceless dental stop have the same treatment (except after *r* [see below]), and the same appears to have also been the case in Greek, at least superficially (see below, however).

Current thinking on the part of a great many Indo-Europeanists is that the traditional voiceless aspirates should not be reconstructed for the Indo-European parent language, being secondarily derived in the daughter languages (cf. Bomhard 1984:18 for references), and, in a great many cases, it is clear that the reflexes found in the daughter languages can indeed be derived secondarily from earlier clusters of voiceless stop plus a following laryngeal (as first suggested in 1891 by Ferdinand de Saussure):

**pH* → Skt. *ph*, etc.

**tH* → Skt. *th*, etc.

**kH* → Skt. *kh*, etc.

As far as the alleged Greek reflex of the traditional dental voiceless aspirate is concerned, we are mostly dealing, in the available Greek examples, with forms in which an earlier laryngeal did not occur. In the Sanskrit cognates, on the other hand, there was an earlier laryngeal, which has left a trace in the form of aspiration. A couple of examples will illustrate the differences between Greek and Sanskrit here:

A. Gk. πλατύς "wide, broad, flat, level" ← *p̥l̥tu-s
 Skt. pr̥thu-ḥ "wide, broad" ← *p̥l̥thu-s

There simply was no laryngeal in the Indo-European ancestor of the Greek form, and, hence, there is no aspiration in Greek.

B. Gk. (Dor.) ὅσταμι "I stand" ← *si-steA-mi
 Skt. t̥iṣṭhati "stands" ← *(s)ti-stA-eti

In this example, Greek has full-grade of the root, and Sanskrit has zero-grade.

There is, however, at least one example in which Gk. ⁹ corresponds to Skt. *th*, namely, the second singular perfect ending found, for instance, in Gk. (F)οῦσ-θα, Skt. vēt-tha from earlier *-tAe.

Unfortunately, the laryngeal explanation does not account for the origin of all examples of voiceless aspirates in the daughter languages. There are several words of onomatopoeic origin that contain reflexes of earlier voiceless aspirates. Among these are (cf. Meillet 1984:80-81):

A. Skt. kákhati "laughs", Arm. xaxank' "guffaw", Gk. καχάζω "I laugh", OCS. xoxotv "guffaw", Lat. cachinnō "I laugh".

B. Skt. phūt-karoti "puffs, blows", Arm. p'uk' "breath, puff", Gk. φῦσα (← *φῦτ̥sa) "a pair of bellows", Lith. pūsti "to blow (air)".

A laryngeal explanation is to be ruled out here. Even though laryngeals cannot account for the presence of aspiration in these forms, the treatment here is identical to that occurring in the examples where the reflexes of earlier voiceless aspirates are to be derived, at the Proto-Indo-European level, from clusters of voiceless stop plus a following laryngeal. We will have more to say about these examples later (section 3).

Finally, there are the notorious Sanskrit examples in which voiceless aspirates are found after initial *s*. These forms have hitherto defied explanation. They will be dealt with in the next section.

Since there is no evidence that the traditional voiceless aspirates were involved in marking distinctive contrasts at the Proto-Indo-European level and since these sounds can be mostly secondarily derived in the Indo-European daughter languages, this series should not be reconstructed for the Indo-European parent language.

3. THE TRADITIONAL PLAIN (UNASPIRATED) VOICELESS STOPS

On the basis of the reflexes found in Sanskrit, Greek, Latin, Baltic, and Slavic, the Neogrammarians (as well as August Schleicher before them) posited a series of plain (unaspirated) voiceless stops for series 1 at the Proto-Indo-European level. The evidence of Germanic, Celtic, and Armenian (along with that of the poorly-attested Thracian and Phrygian), however, points to the presence of aspiration in this series in Proto-Indo-European. Two explanations were available to account for the reflexes found in the daughter languages: (A) loss of aspiration in Sanskrit, Greek, Latin, Baltic, and Slavic and (B) secondary development of aspiration in Germanic, Celtic, Armenian, Thracian, and Phrygian. The Neogrammarians chose the second alternative (cf., for example, Meillet 1984:91-92), and this view has been followed by most scholars until fairly recently. Let us now take a look at the first alternative, that is, the possibility that aspiration was lost in Sanskrit, Greek, Latin, Baltic, and Slavic. We will begin by looking at the developments in Germanic, Celtic, and Armenian, and we will then consider the remaining daughter languages.

In Germanic, we find that the traditional plain voiceless stops are represented by the voiceless fricatives $*f$, $*θ$, $*χ$, $*χw$, which are assumed to have developed from earlier voiceless aspirates, thus (cf. Meillet 1984:91):

$$p \ t \ k \ k^w \rightarrow p^h \ t^h \ k^h \ k^{hw} \rightarrow f \ \theta \ \chi \ \chi w$$

At a later date, medial (and final) $*f$, $*θ$, $*χ$, $*χw$, together with $*s$, became the voiced fricatives $*β$, $*ð$, $*γ$, $*γw$, and $*z$ respectively except (A) before $*s$ or $*t$ and (B) between vowels when the accent fell on the contiguous preceding syllable (Verner's Law).

In Celtic, the traditional plain voiceless stops are assumed to have developed into voiceless aspirates, thus:

$$p \ t \ k \ k^w \rightarrow p^h \ t^h \ k^h \ k^{hw}$$

The labial member was eventually lost, thus:

$$p^h \rightarrow h \rightarrow \emptyset$$

The Armenian developments can be explained by assuming that in pre-Armenian Proto-Indo-European, series 1 was voiceless and aspirated, series 2 was a cluster of voiceless stop plus a following laryngeal, series 3 was glottalized, and series 4 was voiced and aspirated:

	Pre-Armenian PIE		Armenian
1	p ^h ; t ^h ; k ^{yh} ; k ^h	→	h (w, Ø); t ^c ; s; k ^c
2	pH; tH; kH	→	p ^c ; t ^c ; x
3	t [’] ; k ^y ; k [’]	→	t; c; k
4	b ^h ; d ^h ; g ^{yh} ; g ^h	→	b (w); d; j (z); g (j, ž)

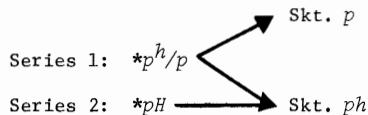
In Armenian, some of the reflexes of series 1 merged with the reflexes of series 2. This happened in the case of the onomatopoeic terms discussed above (section 2), where, for example, earlier *p^h and *k^h became p^c and x respectively in Armenian as if from earlier *pH and *kH (this also occurred for all of series 1 in Sanskrit and Greek, while in Slavic it only took place in the case of *k^h). In like manner, the aspiration of series 1 was preserved in Armenian after initial s-. *t^h and *tH have mostly merged in Armenian, though earlier *rt^h → Arm. rd, while *rtH → Arm. rt^c (cf. Meillet 1984:79).

Thus, the Germanic, Celtic, and Armenian developments can be explained by assuming that series 1 was voiceless and aspirated at the Proto-Indo-European level, that is to say, it is not necessary to posit earlier plain voiceless stops to account for the developments in these daughter languages. Armenian is particularly important in that it has preserved the contrast between the older voiceless aspirates (series 1) and those that developed later from earlier clusters of voiceless stop plus a following laryngeal (series 2). Here, Armenian provides the key to understanding the Proto-Indo-European patterning.

In Sanskrit, Greek, Latin, Baltic, and Slavic, series 1 is represented by plain voiceless stops. This, however, is not the original patterning but is, rather, an innovation. As noted in the preceding paragraph, Armenian provides the key to understanding the Proto-Indo-European patterning. Therefore, on the basis of the treatment of series 1 in Armenian, let us assume that series 1 was originally voiceless and aspirated and, further, that the aspiration was phonemically irrelevant (this, by the way, is the position taken by Gamkrelidze-Ivanov). There were thus two allophones:

p^h/p
t^h/t
k^h/k
k^w/k^w

In Sanskrit, the allophones of series 1 became phonemic -- the aspirated allophones appeared in onomatopoeia and after initial *s*-, while the unaspirated allophones appeared in all other environments:



A few examples will illustrate the treatment of series 1 after initial *s*- in Sanskrit:

- A. Skt. *sphuráti*: Arm. *sp'irk'* and *p'arat*
- B. Skt. *sthágati*: Gk. στέγω and τέγω, Lat. *tegō*
- C. Skt. *skhálāmi*: Arm. *sxalim*

Emonds (1972:120) also assumes that the voiceless aspirates found in Indic, Greek, and Armenian have developed from series 1:

Finally, NIE allows us to view the development of the tense, voiceless aspirates in Indic and Greek in new light. I am not denying, however, that credible theories about their origin have been advanced in terms of TIE (by the introduction of laryngeals, etc.). However, the presence of voiceless aspirates in NIE (the *ph*-series) suggests as one possibility an imperfect operation of LAX or Z2 in just those languages where some laxing took place, but in which all aspirated stops were not eliminated by CG. (By "imperfect operation", I mean the existence of a dialect in which the rule failed to operate, the dialect later dying out after contributing a number of "exceptions" to the previously completed historical change.)

If such an imperfect operation of Z2 took place, it would account for Indic and Greek *ph*'s that correspond to *p*'s in the central group and *ph*'s in Germanic... The fact that the *ph*'s and *x*'s that occur in the Armenian (and Slavic) examples do not correspond to the regular development of NIE *ph* and *kh* in those languages supports the notion that "imperfect operation" of Z2 should be interpreted as reintroduction of words from a dialect that did not undergo Z2 (or the other rules that affected Armenian and Slavic development of *ph* and *kh*).

Whereas Emonds sees the voiceless aspirated reflexes of series 1 in Sanskrit, Greek, and Armenian as due to borrowings, I see them as the natural result of the phonemicization of the allophones of this series.

Aspiration was lost in pre-Sanskrit when an earlier laryngeal followed in the stem:

- A. $*(s)t^h_eHy-$ → $*(s)teHy-$ → $(s)tāy-$ (cf. Skt. *stāyati* "steals", *stāyū-ḥ*, *tāyū-ḥ* "thief, robber");
- B. $*(s)t^h_eHi-$ → $*(s)teHi-$ → $*(s)tai-$ → $(s)te-$ (cf. Skt. *stenā-ḥ* "thief", *stéya-ḥ* "theft, robbery").

Of course, when the voiceless stop and laryngeal were in direct contact, a voiceless aspirate resulted:

$*(s)ti-stA-eti$ → Skt. *tiṣṭhati* "stands"

The resulting voiceless aspirate was then generalized throughout the paradigm and in derivatives (cf. Skt. *sthāpayati* "to cause to stand").

We can now return to the question of the choices that were available to the Neogrammarians: (A) loss of aspiration in Sanskrit, Greek, Latin, Baltic, and Slavic and (B) secondary development of aspiration in Germanic, Celtic, and Armenian. In view of the new theory proposed by Gamkrelidze-Ivanov, it is not so much a question of loss or retention as it is of the phonemicization and generalization of the allophones of series 1 in the various daughter languages, though Germanic, Celtic, and Armenian come closer to the original patterning than do those daughter languages in which series 1 is represented by plain voiceless stops since the aspirated allophones seem to have been primary at the Proto-Indo-European level. In this sense, Sanskrit, Greek, Latin, Baltic, and Slavic have innovated by generalizing the unaspirated allophones of series 1 (for details on the developments leading to loss of aspiration in these daughter languages, cf. Suzuki 1985: 285-94).

4. THE TRADITIONAL VOICED ASPIRATES

According to the traditional reconstruction, series 4 is assumed to have been voiced and aspirated in Proto-Indo-European. The evidence for voicing is overwhelming (Indo-Iranian, Albanian, Armenian, Germanic, Celtic, Baltic, and Slavic), while that for aspiration is limited, coming mainly from Indo-Aryan, Greek, and Armenian. Nevertheless, the assumption that this series was voiced and aspirated at the Proto-Indo-European level remains the best way to account for the reflexes found in all of the daughter languages taken together.

Gamkrelidze-Ivanov also assume that series 4 was voiced and aspirated. They point out, however, that the feature

of aspiration is phonemically irrelevant in a system of this type and that this series can appear either with or without aspiration depending upon the paradigmatic alternation of root morphemes. Specifically, the distributional patterning of the aspirated and unaspirated allophones was as follows, at least in Indo-Iranian and Greek (cf. Gamkrelidze 1976:404):

In particular, when phonemes of [series 4] co-occurred in a root, one of the units was realized as an aspirate, the other as a non-aspirate. Thus, e.g., a root morpheme /*b^heuyd^h/ would be manifested as [*b^heuyd^h-] or [*b^heuyd-] according to the paradigmatic alternations of the morpheme. Grassmann's Law should be accordingly interpreted not as a deaspiration rule operating independently in Indo-Iranian and Greek, but as a rule of allophonic variations, still at the Proto-Indo-European level, of the phonemes of [series 4].

The same assumption could easily, and in a natural way, account for the phenomena described by Bartholomae's Law. A morphemic sequence of /*b^hudh^h-/ and /*-tho-/ would be realized as [*budh^h-] + [*-tho-] → [*budt^ho-] (in accordance with the rule of non-cooccurrence in a sequence, either distant or in contact, of two aspirated allophones), this yielding Old Indian *buddha*, by progressive assimilation on the feature of voice.

For Latin, however, the distributional patterning of the aspirated and unaspirated allophones of series 4 was probably conditioned by the presence of word-initial stress along the lines suggested by Philip Baldi and Ruth Johnston-Staver (forthcoming):

This brings us, finally, to [series 4], what we have represented in PIE as a series of voiced stops with aspirated and non-aspirated allophones. In the traditional framework, it is assumed that *b d g developed straight into Latin *b d g*, and that *b^h d^h g^h split into the new fricative series *f f h* and *b d g*, which latter group merged with the reflexes of the plain voiced stops. In the new framework, a different solution suggests itself, one that accounts well for the distribution of the fricatives and voiced stops in the development of Latin.

We propose that the aspiration feature of the voiced series was conditioned by the syllable-initial stress which is traditionally postulated for Proto-Latin... The usual view is that word-initial stress can be safely posited for Proto-Latin because of the large amount of vowel weakening and syncope in the unstressed syllables of words which can be internally reconstructed with full vowels, e.g. *aetas* < *aevitas*; *afficiō* < *ad + faciō*; *caueps* < *avi + caps*, etc. The Latin data can be interpreted as showing either preservation or development of aspiration, depend-

ing on what sort of system is postulated for the parent PIE dialect. Recall that Gamkrelidze-Ivanov have interpreted the aspirated/non-aspirated allophones of the voiced stops as having the aspirated member as the primary one. On this assumption, the aspirated allophone was generalized in Proto-Italic according to the following rule:

$$/b/ \rightarrow [b^h] / \# [+ \text{stress}]$$

We now have a phonetic motivation, namely the interaction of stress and aspiration, for the distribution of the aspirated and non-aspirated voiced stops in initial and non-initial syllables... Thus, we propose the following scheme for the development of the voiced stops and voiceless fricatives in Latin:

$$\begin{array}{ll} [b^h] > p^h > \Phi > f & [b] > b \\ [d^h] > t^h > \Theta > f & [d] > d \\ [g^h] > k^h > \chi > h & [g] > g(u) \end{array}$$

Baldi and Johnston-Staver further note:

There are some exceptions to the normal development of these sounds as outlined above, and the new interpretation does not eliminate them. It does, however, allow some generalizations not available in previous frameworks.

For Oscan-Umbrian, Baldi and Johnston-Staver assume that the aspirated allophones were generalized in all positions.

To sum up, in Indo-Iranian, Greek, and Latin, the aspirated and unaspirated allophones of this series became phonemic. In the remaining daughter languages, on the other hand, these allophones remained subphonemic.

5. CONCLUDING REMARKS

Series 1 — the traditional plain voiceless stops — should be reinterpreted as voiceless and aspirated. Series 2 — the traditional voiceless aspirates — should be completely eliminated. Series 3 -- the traditional plain voiced stops -- should be reinterpreted as glottalics. Series 4 — the traditional voiced aspirates — remains. The feature of aspiration is phonemically nondistinctive in series 1 and series 4, that is to say that there were positional allophones with aspiration as well as without aspiration. In several of the daughter languages, these allophones became phonemic. We thus arrive at the following reconstruction of the Proto-Indo-European stop system:

1	(2)	3	4
p ^h /p		(p')	b ^h /b
t ^h /t		t'	d ^h /d
k ^h /k		k'	g ^h /g
k ^w h/kw		k'w	g ^w h/gw

This reconstruction agrees in all essential details with the proposals made by Gamkrelidze-Ivanov (1984:5-80).

We can close by taking a look at Suzuki's (1985:287) analysis of the revised Proto-Indo-European stop system:

	T	T'	D
Glottalic	-	+	-
Voiced	-		+
(Aspirated)	+	-	+(+)

Suzuki elaborates:

...[+aspirated] is a redundant feature from a strictly phonological point of view. However, I take this feature to be linguistically relevant in that by virtue of being in complementary distribution with [+glottalic] it has a potentiality for serving as a distinctive marker upon loss of the latter. In this sense, [+aspirated] is a sub-phonemic entity.

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SUMMARY

The traditional reconstruction of the Proto-Indo-European stop system consists of (1) plain voiceless stops, (2) voiceless aspirates, (3) plain voiced stops, and (4) voiced aspirates. A review of the data from the daughter languages shows that series 1 should be reinterpreted as voiceless and aspirated, series 2 should be completely eliminated, series 3 should be reinterpreted as glottalized, and series 4 should remain unaltered.

RÉSUMÉ

La reconstruction traditionnelle du système occlusif de l'indo-européen comporte quatre séries: (1) les sourdes simples, (2) les sourdes aspirées, (3) les sonores simples, et (4) les sonores aspirées. Un examen des données des dialectes indo-européens montre que la série 1 devrait être reconstruite comme des sourdes aspirées, la série 2 devrait être entièrement éliminée, la série 3 devrait être reconstruite comme des glottalisés, et la série 4 devrait rester sans modification.

ZUSAMMENFASSUNG

Die traditionelle Rekonstruktion des Systems der urindogermanischen Verschlußlaute besteht aus (1) einfachen stimmlosen Verschlußlauten, (2) stimmlosen Aspirata, (3) einfachen stimmhaften Verschlußlauten sowie (4) stimmhaften Aspirata. Eine Untersuchung der Daten der Tochtersprachen jedoch legt nahe, daß die 1. Serie neu interpretiert werden sollte, und zwar als stimmlose und aspirierte Laute, daß die 2. gänzlich eliminiert werden könnte, daß die 3. als glottalisierte Laute rekonstruiert werden sollten, während die 4. unverändert bleiben könne.

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